132177-1
(G21-0003)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	10/678,459
Applicant	:	Kenneth Paul Zarnoch et al.
Filed	:	October 3, 2003
TC/A.U.	:	1712
Examiner	:	David J. Buttner
Assignee Docket No.	:	132177-1
Attorney Docket No.	:	G21-0003
Customer No.	:	23413

Via Facsimile (571) 273-8300, TC Group 1700
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION UNDER 37 CFR § 1.131

Kenneth Paul Zarnoch, John Robert Campbell, Glen David Merfeld, John Rude, Prameela Susarla, Michael Alan Vallance, and Gary William Yeager declare and state that:

1. We are the inventors of the invention claimed in the above-identified patent application.

2. We conceived in the United States the invention disclosed and claimed in the above-identified patent application prior to July 25, 2003 and then diligently reduced the invention to practice in the United States prior to July 25, 2003.

3. As evidence in support of this prior conception and reduction to practice, submitted herewith are Exhibits 1, 2, and 3 as evidence of activity done in the United States. Exhibit 1 is a copy of a spreadsheet containing curable composition formulations and test results. Exhibit 2 is a copy of the same spreadsheet in which the content is unaltered but the type size and page breaks have been adjusted so that each of the three tables contained within fits on a single page. Exhibit 3 is a copy of a "patent disclosure document" to which the Exhibit 1 spreadsheet was originally attached. Dates within all three Exhibits have been redacted.

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Date: Oct. 4, 2005 — Kenneth Paul Zarnoch

Date: Oct 4, 2005 — John Robert Campbell

Date: Oct. 4, 2005 — Glen David Merfeld

Date: _____ — John Rude

Date: _____ — Prameela Susarla

Date: Oct 4, 2005 — Michael Alan Vallance

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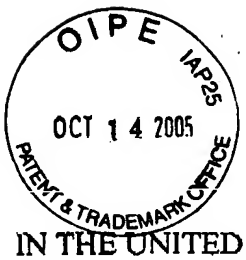

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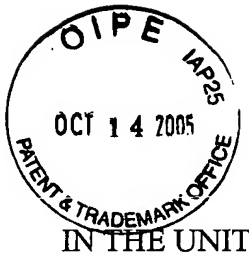

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United States filing date of the application leading to U.S. Patent No. 6,835,786 B2 to Ishii et al.

7. The undersigned declares that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.

Date: _____ _____
Kenneth Paul Zarnoch

Date: _____ _____
John Robert Campbell

Date: _____ _____
Glen David Merfeld

Date: 10/6/05 _____
John Rude

Date: _____ _____
Prameela Susarla

Date: _____ _____
Michael Alan Vallance

Date: _____ _____
Gary William Yeager

EXHIBIT 1

Date	Sample	Description	Spiral flow length, inches	Mold temp, oC	Top platen temp, oC	Plunger pressure x 0.05, psi	Amount of charge, g
30-May	F 4	Base	15.5	129	140	43.5	15
31-May	F 4	Base	13	160		50	15
31-May	F 5	F4 with 0.30 IV PPO	7	160	168	50	15
31-May	F 5	F4 with 0.30 IV PPO	8.5	125	130	40	15
31-May	F 5	F4 with 0.30 IV PPO	8.5		145	50	15
7-Jun	F 8	Diff wax, less than F4	5	150		40	15
7-Jun	F 9	F8 with 1/2 initiator	4	150.5	150	40	15
7-Jun	F 10	F8 with no initiator	6.75	150.7	151.1	40	15
7-Jun	F 11	F8 with 1/2 PPO	11.3	149.8	149.9	40	15
7-Jun	F 12	F8 with added inhibitor	12	150.2		40	15
7-Jun	F 8		2	149.4	151.3	28	15
7-Jun	F 12	F8 with added inhibitor	11.3	150	156	50	15
7-Jun	F 12	F8 with added inhibitor	11	131.3	134.5	40	15

Sample	Temperatures, °C (Mold well)	Spiral Flow Length, inches	
Formulation 4	129-150	14-16	Base
Formulation 5	125-160	8.5	0.30 IV PPO
Formulation 8	150	5	Base + different wax, lower amount
Formulation 9	150.5	4	8 - with ½ peroxide
Formulation 10	150.7	6.75	8 - with no peroxide
Formulation 11	149.8	11.3	8 - with ½ PPO
Formulation 12	150.2	12	8 - with inhibitor

Plunger time, s	Clamp time, s
35	200
45	200
45	200
46	200
45	200
30	200
30	200
30	200
30	200
30	200
30	200
30	200
30	200

Formulation	4	5	8	9
PPO-MA(0.12)	8.7		8.99	8.99
PPO-MA(0.30)		6.1		
Diallylphthalate	8.6	11.2	8.89	9.07
TMPTMA	3.1	3.1	3.2	3.28
Dicumyl Peroxide	0.5	0.5	0.52	0.26
t-butyl catechol				
Lecithin	1.1	1.1		
Esterified Montanic Acid			0.2	0.2
Montanic acid			0.2	0.2
Dibromostyrene	1	1	1	1
Antimony pentoxide	1.3	1.3	1.3	1.3
Carbon black	0.2	0.2	0.2	0.2
Silane coupling agent	0.5	0.5	0.5	0.5
Fused silica	75	75	75	75
Total	100	100	100	100

10	11	12
8.99	4.5	8.94
9.27	12.19	8.89
3.34	4.39	3.2
0	0.52	0.52
		0.05
0.2	0.2	0.2
0.2	0.2	0.2
1	1	1
1.3	1.3	1.3
0.2	0.2	0.2
0.5	0.5	0.5
75	75	75
100	100	100

EXHIBIT 2

Date	Sample	Description	Spiral flow length, inches	Mold temp, oC	Top platen temp, oC	Plunger pressure x 0.05, psi	Amount of charge, g	Plunger time, s	Clamp time, s
	F 4	Base	15.5	129	140	43.5	15	35	200
	F 4	Base	13	160		50	15	45	200
	F 5	F4 with 0.30 IV PPO	7	160	168	50	15	45	200
	F 5	F4 with 0.30 IV PPO	8.5	125	130	40	15	45	200
	F 5	F4 with 0.30 IV PPO	8.5		145	50	15	45	200
	F 8	Diff wax, less than F4	5	150		40	15	30	200
	F 9	F8 with 1/2 initiator	4	150.5	150	40	15	30	200
	F 10	F8 with no initiator	6.75	150.7	151.1	40	15	30	200
	F 11	F8 with 1/2 PPO	11.3	149.8	149.9	40	15	30	200
	F 12	F8 with added inhibitor	12	150.2		40	15	30	200
	F 8		2	149.4	151.3	28	15	30	200
	F 12	F8 with added inhibitor	11.3	150	156	50	15	30	200
	F 12	F8 with added inhibitor	11	131.3	134.5	40	15	30	200

Sample	Temperatures, °C (Mold well)	Spiral Flow Length, inches	
Formulation 4	129-150	**14-16**	**Base**
Formulation 5	125-160	**8.5**	**0.30 IV PPO**
Formulation 8	150	**5**	**Base + different wax, lower amount**
Formulation 9	150.5	**4**	**8 - with ½ peroxide**
Formulation 10	150.7	**6.75**	**8 - with no peroxide**
Formulation 11	149.8	**11.3**	**8 - with ½ PPO**
Formulation 12	150.2	**12**	**8 - with inhibitor**

Formulation	4	5	6	9	10	11	12
PPO-MA(0.12)	8.7		8.99	8.99	8.99	4.5	8.94
PPO-MA(0.30)		6.1					
Diallylphthalate	8.6	11.2	8.89	9.07	9.27	12.19	8.89
TMPTMA	3.1	3.1	3.2	3.28	3.34	4.39	3.2
Dicumyl Peroxide	0.5	0.5	0.52	0.26	0	0.52	0.52
t-butyl catechol							0.05
Lecithin	1.1	1.1					
Esterified Montanic Acid			0.2	0.2	0.2	0.2	0.2
Montanic acid			0.2	0.2	0.2	0.2	0.2
Dibromostyrene	1	1	1	1	1	1	1
Antimony pentoxide	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Carbon black	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Silane coupling agent	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Fused silica	75	75	75	75	75	75	75
Total	100	100	100	100	100	100	100

EXHIBIT 3

****

GE Confidential & Proprietary Information.
This invention is being prepared for submission to the GE Patent And Legal Operation. Attorney work product may be contained herein.

****

GE Patent Disclosure Letter System

DOCKET NUMBER

31383

DOCKET DATE

TITLE OF INVENTION

Molding Material with High Mold Flow

GE TECHNOLOGY AREA(S)

- GE Plastics (PLAS)
- GE Specialty Materials (GESM)

PROJECT NAME

Engineering Composites

PROJECT NUMBER

2140121001

PROJECT LEADER

Vallance, Michael, A

BUSINESS OR ORG. CONTACT INFORMATION

NAME

PHONE NUMBER

Was this invention first conceived or reduced to practice in the performance of work under a contract between GE and

EXHIBIT 3

another non-government third party? NO

Date Invention Conceived .

Circumstances Invention Conceived i.e., described in patent notebook (include page #), technical report, letter, discussed in meeting minutes, etc.
We designed and executed an experiment to understand which factors in our molding compound compositions control flow length in the EMMI spiral flow test (SEMI G11-88 Recommended Practice for Ram Follower Gel Time and Spiral Flow of Thermal Setting Molding Compounds).

Was this invention first conceived or reduced to practice in the performance of work under a US Government contract?
NO

ABSTRACT OF THE INVENTION

Please write a brief explanation of the invention (Limit to 350 words)
Molding materials which cure by free-radical polymerization can be tailored to provide maximum mold flow and minimum mold residence time.

BACKGROUND OF THE INVENTION

Please describe the problem or requirement addressed by your invention.
During the encapsulation of electronic devices with molding compounds, low melt viscosity is required, often less than 10,000 cP for extended time, often for as long as 30 sec. Yet these same molding compounds are expected to cure sufficiently so as to attain hot hardness on the order of 90 or higher on the Shore D scale during short molding times, often as little as 90 sec.

How has this problem or requirement been addressed before?
Most molding compounds in use today comprise epoxy resin, polyphenol hardener, nucleophilic cure accelerator and high filler loading for control of thermal expansion. The organic compounds are chosen to provide low viscosity and slow cure. While sufficient polymerization occurs during the mold cycle to provide for mechanical integrity and sufficient hot hardness for removal of the molded components, extensive post curing, typically 5-6 hours at 175 C, is required to complete the curing process.

Is this disclosure letter related to any GE disclosure letters, patent applications or issued patents?

YES

EXHIBIT 3

Vallance et al. re: PPO and colloidal silica Vallance et al. re: PPO and phosphorus flame retardant

Have you completed a prior art search? NO

Please list any relevant literature or patents of which you are aware.

DETAILED DESCRIPTION OF THE INVENTION

How does your invention work?

A curing chemistry is selected that results in addition polymerization kinetics. Such chemistry polymerizes rapidly and exothermically going to completion in a few seconds, provided there are no steric or diffusion limitations. While such choice of chemistry satisfies the need for rapid cure, spiral flow lengths are too short -- molding performance is unsatisfactory. We have discovered initiator strategies that overcome this shortcoming, providing rapid cure and long spiral flows.

Describe the important features of your invention and explain how to use the invention to solve the problems described above.

In one aspect, the invention is a molding material. The material comprises: thermoplastic, filler, reactive diluent, and initiator. Other components may be present. The reactive diluent comprises a monomer with alkenyl functionality. The initiator comprises a free radical source and a free radical inhibitor. In a second aspect, the invention is a design paradigm. The paradigm comprises: Selection of a free radical source with a decomposition temperature very near to the molding temperature. Incorporation of an excess quantity of said free radical source. Incorporation of a free radical inhibitor in such quantity so that the spiral flow length is limited by the yield stress of the molding compound, which acts essentially as a Bingham fluid, rather than by the increase in viscosity associated with polymerization and/or crosslinking. Balancing the chemistry, so that the mold flow is essentially complete, before chain addition polymerization initiates, yet providing for polymerization at a rapid rate after onset of polymerization, similar to the rate of polymerization expected from an uninhibited system. Formation of a solid solution at room temperature, by the inclusion of a compatible high Tg thermoplastic, such that reaction is further impeded by diffusion control during storage and transport.

What advantages are provided by your invention?

Chain-reaction cure kinetics are rapid in comparison to the polyetherification reaction associated with epoxy-phenolic cure, providing faster molding cycles, stronger as-molded

parts, and shorter post cures (post-cure-free performance in some circumstances). The polymers formed by addition polymerization of alkenyl functional monomers are generally less hydrophillic than the beta-hydroxy ethers formed during epoxy/phenolic cures. Moisture sensitivity is reduced. The inhibition time can be varied widely with subtle changes to the ratios in the initiator system, while impacting neither the polymerization rate nor the properties of the molded part. Therefore the chemistry is easily tunable to different molding geometries. The inclusion of a high-Tg thermoplastic results in improved toughness and, potentially, in lower moisture sensitivity, higher temperature capability, and better insulation properties, depending on the selection of polymer chemistry.

Has your invention been reduced to practice? YES
Date:

Briefly describe any efforts to make a prototype of your invention or to test your invention. Additionally, summarize the results of any related experiments and testing and highlight any results of particular significance.
We designed and executed an experiment to understand which factors in our molding compound compositions control flow length in the EMMI spiral flow test (SEMI G11-88 Recommended Practice for Ram Follower Gel Time and Spiral Flow of Thermal Setting Molding Compounds).

BRIEF DESCRIPTION OF THE DRAWINGS

Please describe the significance of any pictures, drawings, graphs, diagrams, structures or figures and the type of picture along with the specific view or application to the invention.
N.A.

CLAIMED INVENTION

Please identify novel aspects that should be protected within this disclosure letter.

(1) A molding material comprising (a) high Tg thermoplastic, (b) reactive diluent with alkenyl radicals, (c) free radical initiator, (d) free radical inhibitor, and (e) filler, where (i) decomposition temperature of the free radical initiator is near the molding temperature; (ii) the free radical initiator concentration is in excess of the amount required for polymerization of the reactive diluent; (iii) the free radical inhibitor concentration is based on attaining the desired spiral flow length at the selected molding temperature, typically 80-100 cm; and (iv) a solid or highly viscous solution is formed between the reactive diluent and some fraction of the thermoplastic. (2) The molding material of (1) wherein the

EXHIBIT 3

thermoplastic is PPE with number average molecular weight from the range 2000 to 20,000. (3) The molding material of (2) wherein the phenolic hydroxyl radicals on the PPE are capped so as to prevent interference with the curing reaction and/or to enhance compatibility of the PPE with the remainder of the composition. (4) The composition of (1) wherein the reactive diluent cures through vinyl, allyl, acrylate or alkylacrylate radicals, but preferably acrylate or methacrylate. (5) The composition of (1) wherein the free radical source is a peroxide. (6) The composition of (5) wherein the peroxide is dicumyl peroxide or t-butyl peroxybenzoate. (7) The composition of (1) wherein the free radical inhibitor is a phenol or a hydroquinone. (8) The composition of (7) wherein the inhibitor is hydroquinone, hydroquinone mono-methyl ether, t-butyl hydroquinone, or t-butyl catechol. (9) The composition of (1) wherein the filler is silica. (10) The composition of (9) wherein the filler is essentially spherical. (11) The composition of (10) wherein the spherical filler is fused silica and/or colloidal silica. The filler may optionally be treated for improved compatibility with the remainder of the molding material and/or for reduced moisture sensitivity. (12) The composition of (1) wherein the filler is graded so as to essentially consist of particles smaller than a selected size, typically from the range 5 - 100 microns. (13) A process whereby the molding compound of (1) is molded into an article with the mold temperature selected from the range 140 to 170 C.

ATTACHED FILES
(021016,Vallance) Inhibitor Study.ppt
(021127,Susarla) Spiral flow study for Disclosure.xls

DUTY OF DISCLOSURE		
a.	**Have steps been taken to put into use, either outside GE or in our own operations?**	**No**
b.	**Has the invention or a product embodying or using it been sold or offered for sale?**	**No**
c.	**If the invention pertains to a process, have any steps been taken to employ the process commercially (e.g., for product production)?**	**No**
d.	**Has the invention been described in an electronic or printed publication?**	**No**
e.	**Has the invention been described to persons who are not employees of GE?**	**No**
f.	**Are there results available of a prior art search**	**No**

EXHIBIT 3

	pertaining to this invention?	
g.	**Has anyone else associated with the project within GE (marketing, sales, sourcing, etc.) disclosed the invention or offered the invention for sale?**	**No**
h.	**If you answered Questions a-g as "NO", is any use, sale, publication, or disclosure of the invention now contemplated?**	**No**

CO-INVENTORS

Name	Address	Global Tech. Center
John Rude	1-8N Park 200 Apts. Clifton Park, New York zip - 12065	Polymer & Specialty Chemical Technologies (2100)
john campbell	41 pepper hollow Clifton Park, NY zip - 12065	Polymer & Specialty Chemical Technologies (2100)
*Michael Vallance	35 Greyledge Drive Loudonville, NY zip - 12211	Polymer & Specialty Chemical Technologies (2100)
Kenneth Zarnoch	7 Horstman Drive Scotia, NY zip - 12302	Polymer & Specialty Chemical Technologies (2100)
Prameela Susarla	407 Lookout Lane Clifton Park, NY zip - 12065	Polymer & Specialty Chemical Technologies (2100)

**Lead co-inventor*

Primary / Financing Business (or Advanced Technology Program) : GE Plastics

Primary / Financing Component : Engineering Composites

Associated Lab/Program : Polymer & Specialty Chemical Technologies (2100)/Polymer Systems & Composites

Assigned Attorney : S. Brown